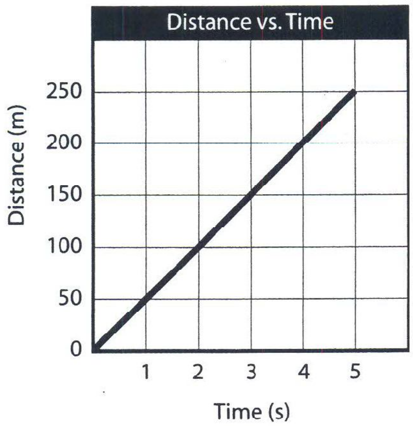
(17)

t (s)	d (m)
0.0	0.0
1.0	50.
2.0	1.0×10^2
3.0	150
4.0	200
5.0	250



The slope is the same as the speed:

$$m = \frac{\Delta y}{\Delta x} = \frac{250 \text{ m} - 0 \text{ m}}{5.0 \text{ s} - 0 \text{ s}} = \frac{250 \text{ m}}{5.0 \text{ s}}$$

$= 50.$ m/s

(18) 0 m/s; 9.81 m/s^2 down

(19) *a* 20 km

b 14 km at 45° north of east

(20) 2

(21) 4

(22) 20.0 s; 491 m

(23) 78 m/s; 310 m

(24) 2

(25) 55 m/s

(26) 25 m/s

(27) 78 km at an angle of 43° east of north

(28) 2

(29) 63 m

(30) 60. m

(31) *a* 33 s; 3900 m

b Student diagrams should show an initial velocity vector at 53° to the horizontal. The parabolic path should be like Figure 2.9, drawn with velocity vectors tangent to the path.

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(32) 2 (34) 2 (36) 3

(33) 1 (35) 4

(37) Angle = 0°:

$F_{net} = 10.\text{ N} + 10.\text{ N} = 20.\text{ N}$

Angle = 90°:

$F_{net}^2 = (10.\text{ N})^2 + (10.\text{ N})^2$

$F_{net} = \sqrt{2.0 \times 10^2 \text{ N}} = 14 \text{ N}$

Angle = 180°:

$F_{net} = 10.\text{ N} - 10.\text{ N} = 0 \text{ N}$

Angle = 0°:

$F_{net} = 70.\text{ N} + 40.\text{ N} = 110.\text{ N}$

Angle = 90°:

$F_{net}^2 = (70.\text{ N})^2 + (40.\text{ N})^2$

$F_{net} = \sqrt{6500 \text{ N}} = 81 \text{ N}$

Angle = 180°:

$F_{net} = 70.\text{ N} - 40.\text{ N} = 30.\text{ N}$

(38) 98.1 N; 39.2 N; 0.41 kg; 1.02 kg

(39) *a* F_{normal}:−203 N; $F_{parallel}$: 457 N

b For a 30° incline: F_{normal}:−433 N; $F_{parallel}$: 250 N

c As the angle of the incline decreases, the normal force increases and the parallel force decreases.

(40) The centripetal force points toward the center of the circle because a force in this direction maintains circular motion.

(41) $T = 0.2$ s; $f = 10$ rev/s

(42) 1

(43) centripetal acceleration: 62 m/s^2: tension: 120 N

(44) Weight depends on gravity and gravity varies depending on how high above Earth the object is.

(45) weight = 98.1 N; mass = 10.0 kg; weight = 16.4 N

(46) 8.0×10^{-8} N

(47) an experiment comparing the acceleration of a baseball and bowling ball being thrown with the same force

(48) 2

(49) 2

(50) 2

(51) 20 N

(52) Ignoring air resistance, the net force on the skydiver and acceleration remain the same because of Newton's second law.

Page 41

(53) $J = 2.0 \times 10^2$ N•s

$\Delta v = 1.0 \times 10^2$ m/s

(54) $m = 1.0 \times 10^3$ kg

$\Delta p = 25{,}000$ kg•m/s

$t = 25$ s

(55) $m = 799$ kg

$\Delta p = 2.00 \times 10^4$ kg•m/s

$t = 200.$ s

(56) *a* $\Delta p = 60.$ N•s

b $\Delta v = 20.$ m/s

(57) $v_{f2} = 11.5$ m/s

$\Delta p_1 = 40.0$ kg•m/s

$\Delta p_2 = 40.0$ kg•m/s

(58) 1200 N

(59) 1 (60) 3

(61) Examples of acceptable responses include:

Momentum conserved?	Diagram at t_1	Diagram at t_2
Yes	m	m
No	m v F_f	m
Yes	m m	m m
Yes	M m	M m
Yes	m m	m m
Yes	M m	M m

(62) 4

Regents Exam Practice, pages 42–48

Part A

(1) 2	(5) 2	(9) 3	(13) 1
(2) 3	(6) 3	(10) 1	(14) 3
(3) 1	(7) 2	(11) 1	
(4) 4	(8) 2	(12) 2	

Part B–1

(15) 2	(17) 3	(19) 4	(21) 1
(16) 3	(18) 4	(20) 4	(22) 2

Part B–2

(23) 1

(24) Sketches should include:

- Three arrows, each originating at point C and having the correct orientation: weight perpendicular to the horizontal, friction parallel to the incline, and normal force perpendicular to the incline.
- Arrowheads in the correct direction: weight directed down, friction directed up the incline, and normal force directed away from the incline.
- Labels: weight or F_g, friction or F_f, and normal force or F_N.

(25) $F_g = mg = (10.0 \text{ kg})(9.81 \text{ m/s}^2) = 98.1$ N

(26) Examples of acceptable responses include:

The block would accelerate.

The speed of the block would not be constant.

The speed of the block would increase.

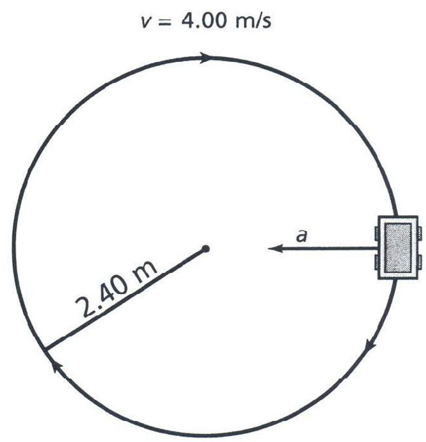
(27) $t = \dfrac{2\pi r}{v}$

$= \dfrac{2(3.14)(2.40 \text{ m})}{(4.00 \text{ m/s})}$

$= 3.77$ s

(28) doubling the speed

(29)



Part C

(30) scale: 40. N/6.6 cm = 6.1 N/cm

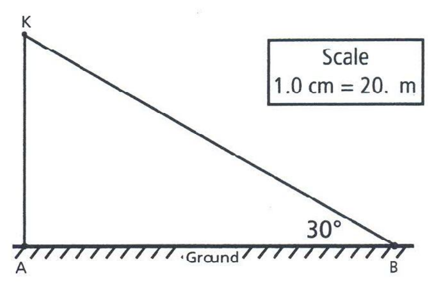
(31) Students should draw a vector that is about 7.4 cm long at an angle of 27° to the horizontal.

(32) $F_{net} = \sqrt{(20.\text{ N})^2 + (40.\text{ N})^2} = 45$ N

(33) 27° north of east

(34) $a = F_{net}/m = 45 \text{ N}/10.\text{ kg} = 4.5 \text{ m/s}^2$

(35) Students should draw a right triangle with AB = 5.0 cm (± 0.2 cm) and a 30.° (± 2°) angle at point B. Points A and K should be labeled correctly.



Example of acceptable response:

(36) 58 m (± 2 m)

(37) Example of acceptable response:

$$d = v_i t + \frac{1}{2}at^2 \text{ or } d = \frac{1}{2}at^2$$

$$t = \sqrt{\frac{2d}{a}}$$

$$t = \sqrt{\frac{2(58\text{ m})}{9.81\text{ m/s}^2}}$$

$$t = 3.4\text{ s}$$

(38) 30.° ± 2°

(39) 140 m ± 20 m

(40) 240 m *or* 140 m + 100 m

(41) Example of acceptable responses:

$$\Delta d = v_i \Delta t + \frac{1}{2}a(\Delta t)^2$$

$$\Delta d = \frac{1}{2}a(\Delta t)^2$$

$$\Delta t = \sqrt{\frac{2\Delta s}{a}}$$

$$\Delta t = \sqrt{\frac{2(240\text{ m})}{9.81\text{ m/s}^2}}$$

$$\Delta t = 7.0\text{ s}$$

or

$$d = \frac{1}{2}at^2 \text{ (from rest)}$$

$$t = \sqrt{\frac{2d}{a}}$$

$$t = \sqrt{\frac{2(240\text{ m})}{9.81\text{ m/s}^2}}$$

$$t = 7\text{ s}$$

Section 3 • Energy

Check for Understanding

Page 49 4 J

Page 50 The kinetic energy of a moving object is proportional to its mass.

Page 52 $P = W/t$ and $W = Pt$, which can have units of kilowatt-hours.

Page 55 In an ideal mechanical system, factors such as friction and air resistance are so small that they can be ignored.

Page 56 The two components of mechanical energy are kinetic energy and potential energy.

Page 57 nuclear energy

Page 59 The label refers to temperature on a Fahrenheit scale.

Page 61 Cooling the balloon causes a decrease in pressure and volume of gas in the balloon.

Page 63 As air escapes from the aerosol can, the decrease in pressure creates a decrease in internal energy. The decrease in internal energy causes the decrease in temperature.

Page 63 The friction between the tire and the road converts mechanical energy to thermal energy, which increases the pressure inside the tire.

Page 64 No; if work is done on a system, heat can flow from a cooler object to a hotter object; this occurs in a heat engine.

Caption Questions

Page 50 Figure 3.2 No work has been done because the force is not in the same direction as the motion.

Page 61 Figure 3.10 The balloon will shrivel because the collision rate among gas particles in the balloon decreases as temperature decreases.

Quick Review

Pages 52–53

(1) The car's kinetic energy is greater.

(2) 4	**(6)** 3	**(10)** 3
(3) 3	**(7)** 2	**(11)** 2
(4) 2	**(8)** 4	**(12)** 1
(5) 4	**(9)** 2	

(13) *a* 2.0×10^2 N
b 5.9×10^4 J
c 2.40×10^5 J
d 130 W

(14) 2	**(15)** 3	**(16)** 4

Pages 54–55

(17) 1	**(20)** 2	**(23)** 0.101 J
(18) 3	**(21)** 41 J	
(19) 3	**(22)** 3190 J	

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(24) 1	**(26)** 1
(25) 1	**(27)** 3

Page 61

(28) 2

(29) The energy needed to vaporize 30.0 grams of water is greater because it takes almost seven times more energy per gram to vaporize water than it does to melt ice.

(30) 4

(31) When objects are in thermal contact, energy is transferred in particle collisions. There is a net transfer of energy from hotter objects to colder objects because hotter objects have more particles with higher energies.

Page 64

(32) 2 (33) 2 (34) 2

(35) 1

(36) Yes; the second law of thermodynamics is not violated because either work must be done on the system or thermal energy must leave the system. In either case, the total entropy of the universe increases.

(37) 3

Regents Exam Practice, pages 65–68

Part A

(1) 2	(5) 2	(9) 1	(13) 2
(2) 1	(6) 4	(10) 4	(14) 4
(3) 1	(7) 4	(11) 3	(15) 4
(4) 4	(8) 1	(12) 1	(16) 1

Part B–1

(17) 4

(18) 1 (19) 3 (20) 3

(21) $\Delta PE = mg(h_2 - h_1)$

(22) 4

Part B–2

(23) 1

(24) Example of acceptable response:

$$KE = \frac{1}{2}mv^2$$

$$v = \sqrt{\frac{2KE}{m}}$$

$$= \sqrt{\frac{2(32\text{ J})}{4.0\text{ kg}}}$$

$$= \sqrt{16\frac{\text{m}^2}{\text{s}^2}}$$

$v = 4.0$ m/s *or* $v = 4.0\sqrt{\frac{\text{J}}{\text{kg}}}$

(25) The speed of the mass at 6.0 s and the speed of the mass at 10.0 s are both 4.0 m/s.

Part C

(26) $W = Fd$

$W = (680\text{ N})(3.5\text{ m})$

$W = 2.4 \times 10^3\text{ N}\bullet\text{m}$

or

$W = 2400\text{ J}$

(27) $P = \frac{W}{\Delta t}$

$P = \frac{(2400\text{ J})}{(11.4\text{ s})}$

$P = 2.1 \times 10^2\text{ W}$

or

$P = \frac{W}{t}$

$P = \frac{(2380\text{ J})}{(11.4\text{ s})}$

$P = 210\text{ J/s}$

(28) The power developed during the 11.4-second trial is less than the power developed during the 8.5-second trial.

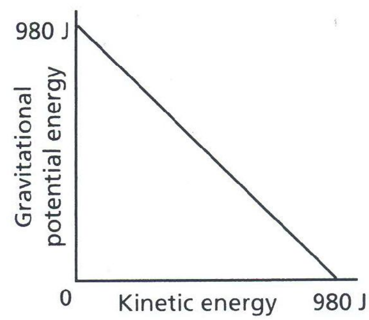
(29) $\Delta PE = mg\Delta h$

$\Delta PE = (20.\text{ kg})(9.81\text{ m/s}^2)(5.0\text{ m})$

$\Delta PE = 980\text{ J}$ *or* $9.8 \times 10^2\text{ kg}\bullet\text{m}^2/\text{s}^2$

(30) 980 J

(31)



Section 4 • Electricity and Magnetism

Check for Understanding

Page 70 Conduction requires objects to come into contact with each other; induction requires close proximity but no contact.

Page 71 k is the electrostatic constant and its value is $8.99 \times 10^9\text{ N}\bullet\text{m}^2/\text{C}^2$

Page 74 An electric field is the modified space around a charge. Forces act on charged objects within the field.

Page 75 Volts are the unit of measure for the electric potential difference.

Page 75 One plate is positively charged; its complementary plate is negatively charged.

Page 76 the force exerted by the electric field between the charged plates

Page 78 An ampere is the SI unit for measuring the magnitude of current. It is defined as 1 coulomb per second.

Page 79 an energy source (battery) and a wire